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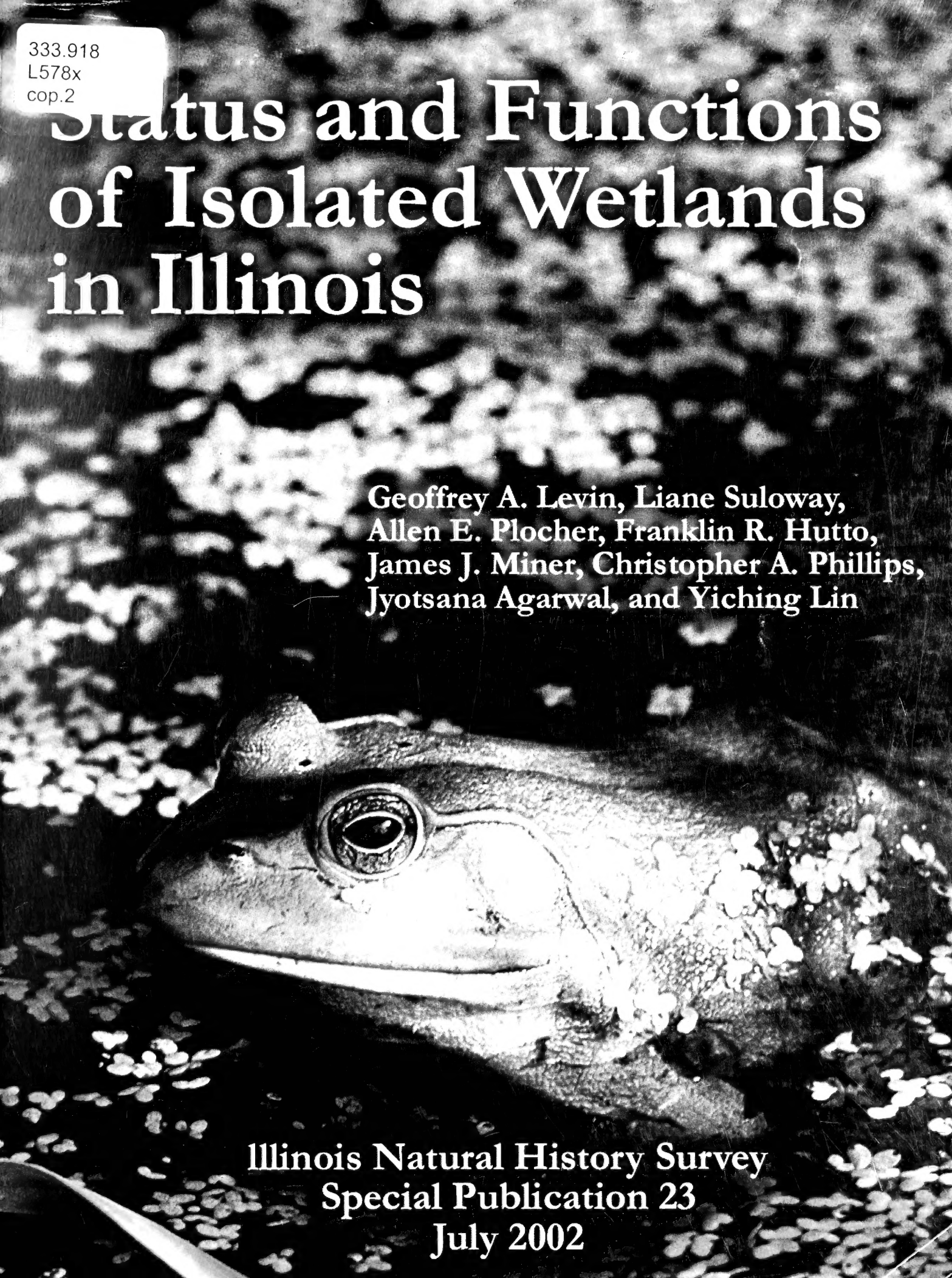

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Contents

Executive Summary

More than half of the wetlands in the conterminous United States have been destroyed, and Illinois has lost about 90% of its wetlands. In a effort to slow further loss, wetlands were protected under the federal Clean Water Act. However, the 2001 United States Supreme Court decision in Solid Waste Agency of Northern Cook County *v.* United States Army Corps of Engineers ruled that federal protection under the Clean Water Act does not extend to "non-navigable, isolated, intrastate" wetlands. This action has left a large but undetermined number of isolated wetlands without this protection. This report summarizes the functions of isolated wetlands and estimates the number and extent of isolated wetlands in Illinois.

The U.S. Supreme Court did not provide a precise definition of "isolated wetland." For the purpose of this report, a wetland is considered isolated if it is not connected to a tributary of a navigable stream by surface flow, outside the 100-year floodzone of a navigable stream, and not used for commercial operations that would permit application of the interstate commerce clause of the U.S. Constitution. Other studies have used somewhat different definitions, and the courts will have to determine the final legal definition. Agencies attempting to regulate isolated wetlands often have avoided this issue by referring to "non-federal" wetlands.

Isolated wetlands perform many vital functions. They act as reservoirs, trapping runoff and thereby reducing flooding. By reducing the velocity and volume of floodwaters, they also reduce erosion. Some of the water captured by isolated wetlands enters the groundwater system, recharging aquifers and sustaining other wetlands. Isolated wetlands serve as sediment traps, improving water quality and slowing sedimentation of lakes and rivers. Water quality is also improved as isolated wetlands filter excess nutrients and pollution from the water that enters them. Wildlife benefits tremendously from isolated wetlands, which serve as habitat for a unique and diverse set of plants and animals, many of them threatened or endangered. Isolated wetlands are especially important habitat for amphibians like frogs and salamanders, which are disappearing both in Illinois and globally. Both isolated and non-isolated wetlands share many of these functions but, in relationship to their number and size, isolated wetlands are particularly important in reducing flooding, trapping sediment, and providing wildlife habitat.

A statewide inventory of isolated wetlands was attempted using existing Geographic Information System (GIS) databases. Isolated wetlands were estimated to account for 12% of the state's wetland acreage, with an average size of 1.1 acres for isolated wetlands vs. 12.3 acres for non-isolated wetlands. Most isolated wetlands in Illinois are open water wetlands (mainly small shallow ponds), wet meadows, shallow marshes, or forested wetlands.

A field survey of a small watershed in Lake County, Illinois, demonstrated that existing GIS resources are inadequate to provide more than an estimate of isolated wetland number and acreage statewide. Specifically, these resources both missed isolated wetlands in the studied watershed and identified areas that were not wetlands. These errors likely are approximately off-setting on a large scale, and thus the GIS data still provide a good statewide estimate of isolated wetlands. However, the need for site specific information in developing wetland protection programs is obvious. On-the-ground surveys currently are required under regulations affecting federally protected wetlands and are feasible for isolated wetlands. Thus the lack of an accurate inventory should not be seen as an impediment to developing regulations protecting isolated wetlands.

Introduction

Wetlands were once viewed as worthless swamps, breeding diseases and standing in the way of farming and development. Landowners drained and filled wetlands, often with the encouragement of federal, state, and local governments. As a result of these activities, more than half of the wetlands in the conterminous United States have been destroyed.[1] Illinois has lost more than 90% of its wetlands, and wetlands now occupy only about 3.5% of Illinois.[2] Wetlands continue to be lost, and many of those remaining are becoming degraded due to fragmentation, siltation, modification of hydrological conditions, and invasion by exotic species.

In 2001, the U.S. Supreme court ruled that protection under the U.S. Clean Water Act does not extend to "non-navigable, isolated, intrastate" wetlands.

Yet wetlands serve many important functions.[1] By acting as reservoirs, they slow water runoff, thereby decreasing erosion and reducing flooding in downstream areas. Through both biological and chemical processes, wetlands protect water quality by removing excess nutrients and pollutants. A great diversity of plants and animals, many of them threatened or endangered, depend on wetlands. Wetlands also offer many recreational opportunities as people enjoy the associated wildlife, or simply their inherent beauty, solitude, and serenity.

In an effort to protect remaining wetlands and their beneficial functions, the federal government adopted provisions in the Clean Water Act requiring the Army Corps of Engineers (USACE) and the United States Environmental Protection Agency (USEPA) to regulate wetlands. Most states, including Illinois, have depended on federal law to protect their wetlands rather than enacting state-level laws and regulations. In January 2001, the United States Supreme Court, in Solid Waste Agency of Northern Cook County (SWANCC) *v.* United States Army Corps of Engineers, ruled that federal protection does not extend to "non-navigable, isolated, intrastate" wetlands. This action left an undetermined—but unquestionably large—number of isolated wetlands without any legal protection. State or local regulations protecting isolated wetlands have been adopted in many areas, including several counties in Illinois.

This report documents the status and functions of isolated wetlands in Illinois. A combination of existing Geographic Information System (GIS) data and newly collected field data are used to estimate the number and distribution of isolated wetlands. Limitations in existing data are assessed and approaches that could be used to inventory isolated wetlands in the state are presented. This report also summarizes the functions of isolated wetlands and the potential impacts on wildlife habitat, flood control, and water quality that may result from their loss.

Isolated wetlands have not been defined legally, but generally speaking they have no clear surface connection to other waters.

What Are Isolated Wetlands?

Wetlands take many forms, from heavily wooded swamps to bogs and even small seasonal ponds (see "Isolated Wetland Types in Illinois", page 8). What unifies all wetlands is that they are ecosystems that depend on constant or recurrent, shallow inundation or saturation by surface or groundwater. As a result of this distinctive hydrology, wetlands generally develop characteristic hydric soils and vegetation adapted for life in saturated soil conditions. Thus there are three criteria for identifying wetlands: hydrology, soil, and vegetation.[3]

Although it is possible to define "wetland," it is harder to define "isolated." There currently is not a federal or state definition for exactly what parameters must exist for a wetland to be considered isolated. The Supreme Court in SWANCC *v.* USACE used the term isolated, but never defined it. A wetland that is directly connected by surface flow to an interstate or navigable stream, river, or other body of water is not isolated. However, many wetlands near headwaters or other interstate or navigable waters are not normally connected to these waters, but may connect during certain conditions. Examples would include wetlands in a river's floodplain, which would be connected to the river during floods but not at other

times. The U.S. Fish and Wildlife Service considered several definitions of isolated wetlands. They concluded that the most appropriate definition emphasized isolated wetlands having no clear hydrologic connections to other water bodies.[4] The legal definition of "isolated" will depend on regulations issued by the USACE and USEPA and the results of future litigation.

In its SWANCC decision, the Supreme Court also considered other criteria for delimiting federal authority over wetlands. Because the commerce clause of the U.S. Constitution provides the major basis for extending federal authority over what otherwise would be state issues, the role of wetlands in interstate commerce was a central part of the Court's reasoning. Thus wetlands that are connected or adjacent to interstate or navigable waters remain protected under the federal Clean Water Act, as noted above. Furthermore, the currently accepted interpretation is that intrastate waters used commercially, for example lakes that support recreational or sport fishing associated with commercial ventures such as bait shops or marinas, are under federal authority, as are the wetlands associated with them. The few court tests thus far support this interpretation.

State and local governments adopting legislation to protect isolated wetlands have had to face this uncertainty about which wetlands are affected. Rather than trying to define isolated wetlands, most such legislation has referred to "non-federal wetlands." This flexibility allows state or local authority to adapt to any changes in federal authority resulting from future federal legislation, regulation, or litigation.

Functions of Isolated Wetlands

Isolated wetlands, despite their generally small size, serve the same functions as other wetlands, and in some cases have unique functions.

Wetlands serve a variety of environmental functions related to hydrology, water quality, and ecology. Hydrological functions include such benefits as flood control, erosion reduction, and groundwater recharge.[5] Wetlands affect water quality by reducing sedimentation of waterways and filtering or otherwise removing excess nutrients and pollutants.[5] Because of their distinctive ecology, wetlands support a great diversity of plants and animals, many of them threatened or endangered.[2] Wetland organisms are important in their own right and as a source of human enjoyment, providing recreational and aesthetic opportunities. Isolated wetlands, despite their generally small size, serve the same functions as other wetlands, and in some cases have unique functions.[4]

Any discussion of wetland function must begin with an understanding of wetland hydrology. This is because hydrology is the prime driving force in wetlands.[1] The source, amount, timing, and duration of inundation are the main factors that determine the way in which the wetland functions and what plants and animals occur there. Wetlands are extremely sensitive to changes in hydrology, so efforts to protect them and preserve their functions must focus not only on the wetlands themselves, but also on the hydrology that supports them.

Wetlands exist wherever there is an excess of water at or near the soil surface for an extended duration. That water can come directly from precipitation, groundwater discharge, surface runoff, or overflow from streams or rivers. Similarly, water leaves wetlands by evapotranspiration (the combination of evaporation directly from the water surface and through the wetland's plants), surface discharge, and infiltration into groundwater. Water budget is the term for the net total of all the water entering and leaving a wetland (Figure 1). Together with its storage capacity—the volume of water the wetland can hold, the water budget determines the wetland's seasonal water level pattern, or hydroperiod.

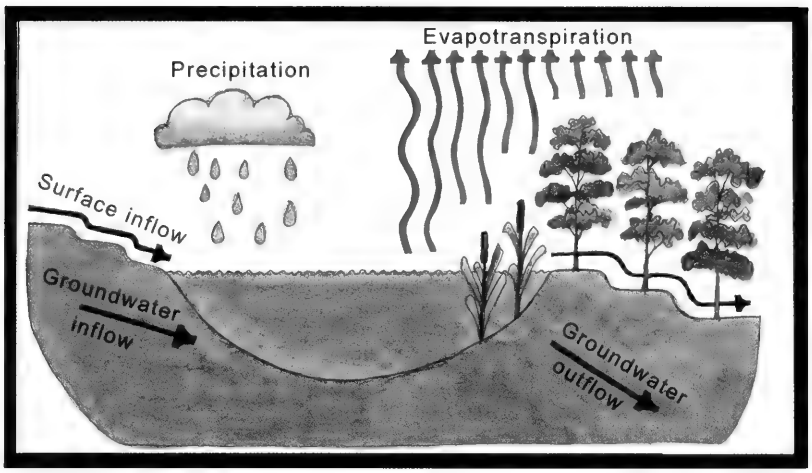

Figure 1. The water budget of a wetland is the net total of water entering through precipitation, surface inflow, and groundwater inflow, and leaving through evapotranspiration, surface outflow, and groundwater outflow. Modified from Welsch et al. (1995)[10].

Flood Control

During periods of heavy precipitation, wetlands fill with water, which they then slowly release over time. Thus wetlands serve a natural flood control function (Figure 2). An Illinois study concluded that increasing wetland area in a basin by 1% decreased peak flood flow by 3.7%, decreased total flood flow by 1.4%, and increased low flows by 7.9%.[6] Other studies have found that basins containing more than 30% lake and wetland area have peak flood flows 60-80% lower than basins with no wetlands or lakes.[7,8]

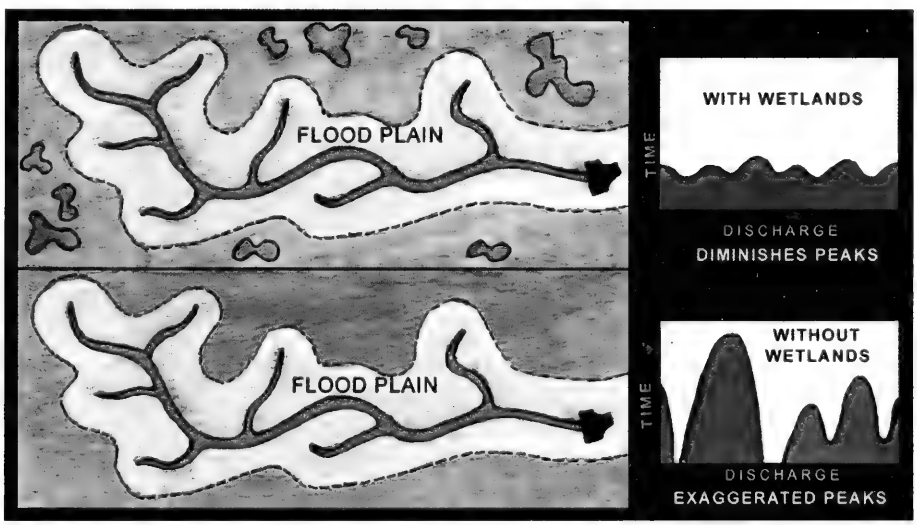

Figure 2. Streams and rivers in watersheds with wetlands experience more even flows and therefore fewer and less severe floods than those in watersheds without wetlands. Modified from Welsch et al. (1995)[10].

Although few studies have focused on isolated wetlands, water storage appears to be one of their primary hydrologic functions.[4] Because isolated wetlands can contribute significantly to local flood abatement, many state and local governments, including four Illinois counties, have adopted measures to protect wetlands, including those that are isolated, as important elements of their stormwater management plans.

One of the most important functions of isolated wetlands is water retention, reducing flooding and erosion.

Erosion Reduction

In the same way that wetlands reduce flooding, they also decrease erosion.[4] Water flowing across the land surface or in tiny rills slows or stops as it enters a wetland. As the water slows, any soil it carried is deposited in the wetland. Furthermore, by reducing the velocity and volume of runoff, erosion of fields and streambanks is lessened downstream. In an agricultural state like Illinois, wetlands therefore offer protection for one of our most important resources, our rich soil.

Groundwater Recharge

Some wetlands recharge groundwater.[4] Water that does not leave a wetland through surface flow and evapotranspiration seeps into the soil to enter the groundwater system. This recharge may flow to nearby wetlands or waterways and help sustain them (Figure 3). Shallow aquifers, which can be important for domestic water supplies, are likely to be threatened if recharging wetlands are disrupted or destroyed. Isolated wetlands, which by their very nature have no surface connections, may be particularly important for groundwater recharge.

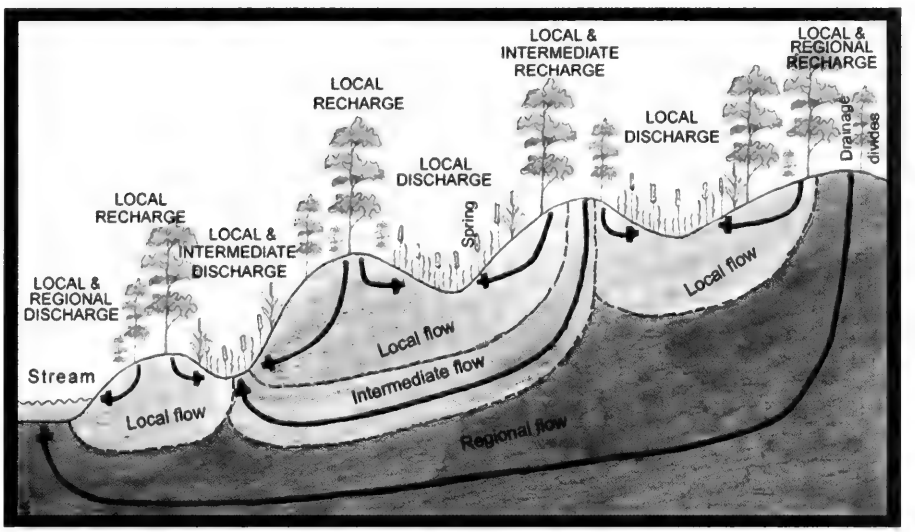

Figure 3. Groundwater systems are recharged by wetlands, with some of the water maintaining wetlands and streams. Modified from Carter (1996)[5].

Sedimentation Reduction

Isolated wetlands are sediment traps, retaining all the soil that enters them.

Sedimentation of waterways throughout Illinois is a major problem.[2] Many of our streams and rivers are increasingly clogged with sediment washed from surrounding land, seriously impeding navigation, reducing recreational opportunities, and degrading natural communities of plants and animals. Dramatic examples of this problem can be seen at Peoria Lake and other portions of the Illinois River, but the impact is widespread with few of our state's waterways unaffected. All wetlands reduce erosion, and isolated wetlands, in particular, are sediment traps, retaining all the soil that enters them.[4] With the loss of more than 90% of our wetlands, it is no wonder that we have major sedimentation problems. Losing more wetlands, especially isolated ones, will only exacerbate the problem.

Pollution Reduction

Wetlands, including those that are isolated, can improve water quality by removing excess nutrients and pollutants.

Wetlands filter and otherwise remove excess nutrients and pollutants from the water that enters them.[5] Some of the nutrients and pollutants are trapped in the sediments, where some may be broken down by bacteria and other microorganisms and others are simply held in place. Plants growing in the wetland also take up some of these chemicals. Nutrients like nitrogen and phosphorus, which can be particular problems in Illinois due to use of fertilizers on lawns and farm fields, are very effectively trapped by wetlands (Figure 4). Because wetlands can clean water, some municipalities have actually used created wetlands as part of their wastewater treatment process.[1] Natural wetlands can play this role for stormwater, which can be heavily laden with nutrients and pollutants washed from lawns and paved areas. Protecting water quality is another reason some state and local governments have included wetland protection in their stormwater management plans.

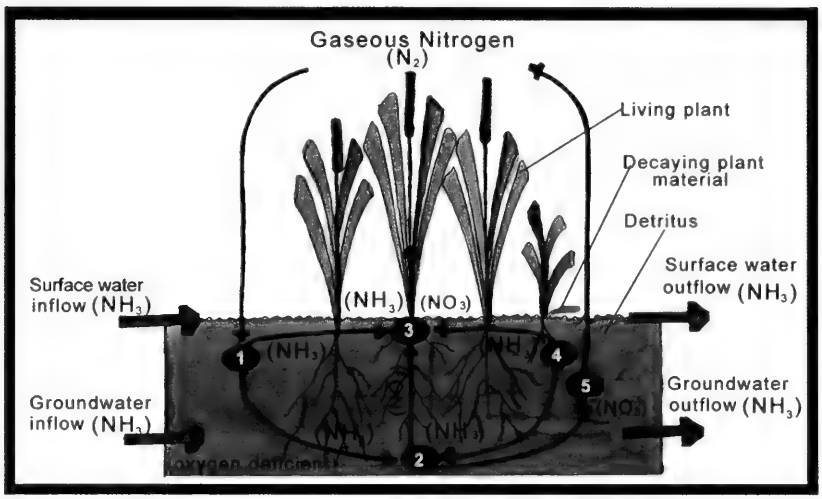

Figure 4. Simplified diagram of the nitrogen cycle in a wetland. Wetlands can improve water quality by removing excess nutrients and pollutants. Modified from Carter (1996)[5].

Wildlife Habitat

Wetlands, including those that are isolated, are very important wildlife habitat. A great diversity of organisms are dependent on or strongly associated with Illinois' wetlands, and are known or suspected to utilize both isolated and non-isolated wetlands (Table 1). About 860 native plant species are considered wetland species, representing 42% of the state's native flora. Among vertebrate animals, amphibians are the most closely associated with wetlands, with fully 90% of Illinois' species dependent of wetlands. Relatively few mammals are dependent on wetlands. Over 100 bird species, 38% of the species regularly found in the state, are associated with wetlands, and nearly all the remaining bird species can sometimes be found in wetlands. Twenty-two percent of the state's reptiles, including most turtles and many snakes, are associated with wetlands. Although many fish require wetlands for feeding or spawning, few of these are found in isolated wetlands. Little information is available on the numbers of insects and other invertebrates that are dependent on or associated with wetlands.

Like many amphibians, gray treefrogs utilize isolated wetlands for breeding and tadpole development. Photo by Christopher A. Phillips.

As might be expected in a state that has lost more than 90% of its wetlands, populations of most Illinois wetland species have been declining tremendously. Many of these species are so close to disappearing that they have been listed as threatened or endangered by the State of Illinois (Table 1). Although some of these species use both isolated and non-isolated wetlands, many amphibians thrive only in isolated wetlands where they are subjected to less predation by fish. (This subject is discussed further below.) As wetlands, and particularly isolated wetlands, continue to be lost, more species will become threatened or endangered, and some will be lost altogether.

Ninety percent of Illinois' amphibians are dependent on wetlands, as are large numbers of other organisms.

Table 1. Numbers and percentage of native species that are dependent on or closely associated with wetlands in Illinois, and the proportion of those species that have been listed as threatened or endangered by the State. Data extracted from Illinois Department of Energy and Natural Resources and Illinois Natural History Survey (1994).[2]

Group of Organisms	Number	% of native species	% threatened or endangered
Plants	862	42	18
Birds	105	38	29
Amphibians	37	90	19
Reptiles	13	22	46
Mammals	6	10	33

Yellow-headed blackbirds are disappearing from Illinois as their marsh habitat has been destroyed. Photo by Michael R. Jeffords.

The marbled salamander breeds only in isolated wetlands that dry temporarily every summer. Photo by Christopher A. Phillips.

There are several reasons isolated wetlands are particularly important wildlife habitat. First, these wetlands generally are not good fish habitat. They often are shallow and freeze to the bottom in winter or dry out in summer, so fish are unable to survive. In the absence of fish, other species thrive. This is especially true of many amphibians, which are dependent on wetlands for their reproduction. Fish feed heavily on eggs and young of many small frogs, toads, and salamanders, so in wetlands with fish, reproduction by some amphibians is very low or even absent. These species depend on fish-free isolated wetlands for their survival. In Illinois, as elsewhere, populations of many amphibians have declined precipitously, and the decline continues. Habitat loss is a major contributor to this decline. Preserving isolated wetlands, the prime habitat for many of these species, will be necessary to prevent their extinction in Illinois.

Isolated wetlands are particularly important for amphibians because they thrive in the fish-free habitat isolated wetlands provide.

Isolated wetlands are generally small, in Illinois averaging about one acre in size (see "Statewide Analysis of Isolated Wetlands Using Geographic Information Systems Technology," page 10). Thus they might be expected to support few species. However, studies have shown that the number of amphibian species in ponds and other depression wetlands is unrelated to size, with even wetlands of less than one acre supporting as many species as much larger wetlands.[9] These studies also found that small wetlands, particularly those with a short hydroperiod, support a different set of species than larger, long-hydroperiod wetlands. Preserving the full diversity of amphibian species depends on maintaining a range of wetland sizes—including small, isolated wetlands, even those that dry up seasonally. Although these studies have focused on amphibians, the same is likely true for insects, other invertebrates, and plants.

Another consideration for wildlife is the way isolated wetlands function together. Although not physically connected, isolated wetlands often occur near each other and near non-isolated wetlands. Animals using the wetlands may move among them, and the pollen and seeds of plants may disperse across the intervening land (Figure 5). Thus although physically isolated, these wetlands may be ecologically interconnected, but only if enough wetlands are close enough together. Thus the abundance and proximity of wetlands are more important than size alone.[9]

The marsh rice rat, threatened in Illinois, is among the few mammals dependent on wetlands in the state. Photo by James F. Parnell.

Many insects and other invertebrates are dependent on wetlands. The Hine's Emerald Dragonfly is an endangered species that is declining due to loss of its habitat. Photo by Dan Soluk.

As wetlands, even small ones, are lost, the distances between the remaining wetlands may become so great that many organisms are unable to disperse among them. As the ecological connections are lost, species will decline and eventually disappear. Preserving these species requires maintaining the ecological connectedness of wetlands on the landscape. Few studies have addressed the issue of how close together wetlands need to be to remain ecologically connected, and none have been undertaken in Illinois. However studies of some amphibian species indicate that they cannot disperse more than about two-thirds of a mile.[9] Maintaining a series of wetland "stepping stones" closer together is required to sustain a healthy population of these species. Examples of species loss due to elimination of ecological connectedness may be emerging in the western United States, and can be expected in other regions if the loss of small, physically isolated wetlands continues.[9]

Isolated wetlands support a diverse set of species that is different from that found in non-isolated wetlands.

Even when a wetland is ecologically isolated, it retains importance for wildlife. Because about 90% of Illinois' wetland habitat has been destroyed, the remaining 10% provides the lifeline for wetland-dependent plants and animals. The loss of more wetlands pushes these species closer and closer to extinction in Illinois and perhaps globally.

The abundance and proximity of wetlands are more important than size alone.

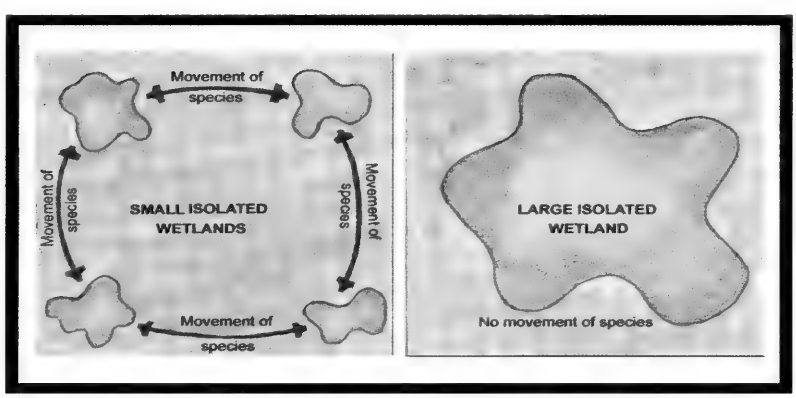

Figure 5. Plants and animals can move among small wetlands that are close enough together and are less likely to become locally extinct than if they are restricted to a single, larger wetland.

Isolated Wetlands Types in Illinois

Illinois has a wide diversity of wetlands, but four types—open water wetlands, shallow marshes and wet meadows, deep marshes, and forested wetlands—make up about 98% of the state's isolated wetland acreage (Figure 8). These wetland types are described in more detail below. Some other types, including swamps, scrub-shrub wetlands, shallow lakes, and shallow rivers, may be fairly common but rarely are isolated. The remaining wetland types, which include bogs, fens, pannes, and seeps, are quite rare and data are insufficient to assess their frequency of isolation. The authors' personal observations suggest that fens and seeps rarely are isolated, bogs sometimes are isolated, and pannes always are isolated. Regardless of their frequency of isolation, all wetland types have the hydrologic or biological functions described above. The rare wetland types may be particularly important biologically. For example, due to their peculiar chemistry and hydrology, fens and bogs each support 34 species listed as threatened or endangered by the State of Illinois, more than any other wetland type in the state. More information on wetland types and their status in Illinois can be found in references 1 and 2.

Most isolated wetlands in Illinois are open water wetlands (mainly small shallow ponds), wet meadows, shallow marshes, or forested wetlands.

Open Water Wetlands

Over half of Illinois' isolated wetland acreage consists of open water wetlands. These are small (less than 20 acre [8.1 ha]) and shallow (less than 6.6 ft [2 m]) bodies of water, mostly natural ponds and open water areas in marshes. They support a variety of plants, including arrowhead, pond lily, and water lily. Scattered about the state, but more frequent in the northeastern and southwestern parts, nearly 60% of open water wetlands are isolated.

Photo by Michael R. Jeffords.

Shallow Marshes and Wet Meadows

Wet meadows and shallow marshes account for about 26% of Illinois' isolated wetland acreage. These are dominated by sedges, grasses, and other rooted herbaceous plants. Standing water or saturated soil are present for brief or moderate periods during the growing season. Examples of this wetland type include sedge meadows and wet prairies (shown in the photo). Once common throughout the state, shallow marshes and wet meadows have been significantly reduced by draining and filling for agriculture and development. Nearly one-quarter of the remaining acreage of wet meadows and shallow marshes is isolated.

Photo by Michael R. Jeffords.

Deep Marshes

Photo by Michael R. Jeffords.

About five percent of isolated wetland acreage in Illinois is deep marsh. Like shallow marshes, deep marshes are characterized by rooted herbaceous vegetation. However, standing water and saturated soil are present for most or all of the growing season. Deep marshes, often dominated by cattails, are now found mainly in northeastern Illinois. About 20% of deep marsh acreage in Illinois is isolated.

Forested Wetlands

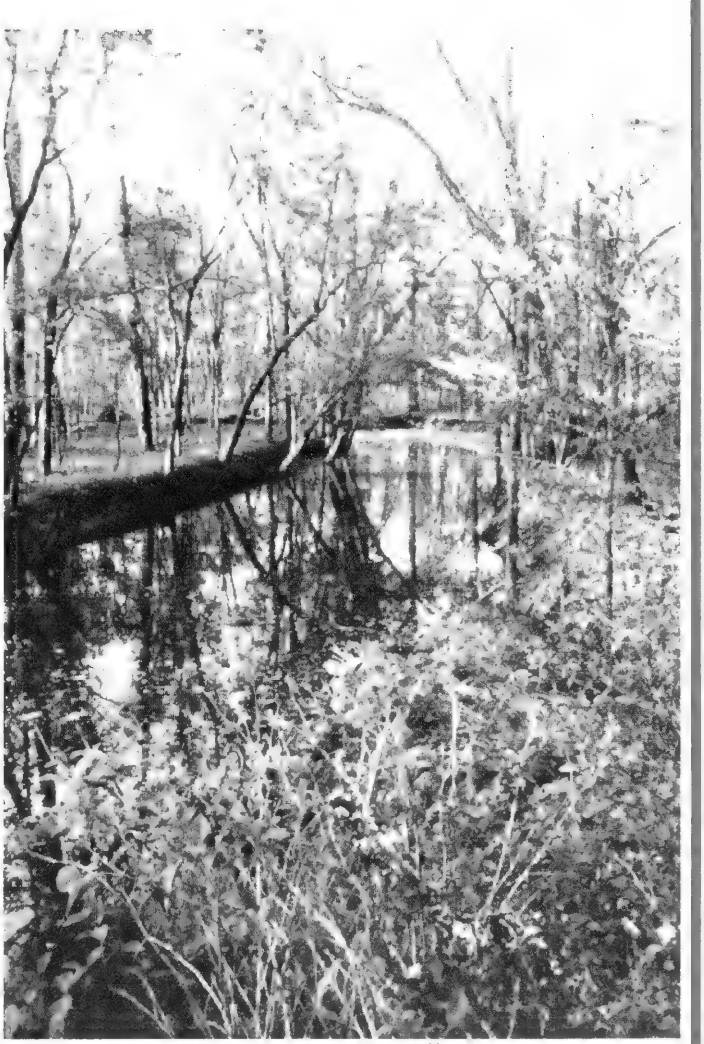

Photo by Michael R. Jeffords.

Accounting for about 10% of Illinois' isolated wetland acreage, forested wetlands are characterized by trees at least 20 feet (6 m) tall and are only temporarily or seasonally flooded. The understory is generally open, because few shrubs and herbs can tolerate prolonged ponding under a dense tree canopy. Forested wetlands are the most abundant wetland type in Illinois, and most lie along the major rivers in the southern third of the state. Because most forested wetlands lie within floodplains, less than 2% of their acreage is isolated.

Statewide Analysis of Isolated Wetlands Using Geographic Information Systems Technology

To assess the status of isolated wetlands in Illinois, a statewide analysis of wetlands was conducted. Because an on-the-ground survey was not feasible, Geographic Information Systems (GIS) databases and technology were used to estimate number and acreage of isolated wetlands. The National Wetlands Inventory (NWI), the Illinois portion of which was conducted in the early 1980s by the U.S. Fish and Wildlife Service using high altitude aerial photography, is the most current, statewide, digital wetlands database available. To be considered isolated, a wetland must not be connected or adjacent to navigable waters (see "What Are Isolated Wetlands?", page 1). To assess connection with navigable waters, the U.S. Environmental Protection Agency Reach File 3 (RF3), which provides the locations of streams and rivers in Illinois, was used. The Federal Emergency Management Agency (FEMA) 100-year floodzones database was used to exclude wetlands that are adjacent to waterways, i.e., those within the reach of 100-year floods.

Although the best available digital databases were used in the analysis, each has characteristics that may affect the reliability of the results. Potential errors and uncertainties in using these databases to estimate wetlands are:

- Because the NWI was not verified in the field, it does not include some wetlands and shows wetlands where none existed; the extent of these errors is unknown.
- The NWI records the location of some wetlands inaccurately, with some NWI wetlands displaced by as much as 250 feet from their true position; the number of wetlands affected by this is unknown.
- The NWI in Illinois is relatively old, given that an unknown number of wetlands have been destroyed since the inventory was completed about 20 years ago.
- The RF3 database does not include all headwaters; the extent of these omissions is unknown.
- The FEMA floodzone database does not include incorporated areas.

Insofar as possible, adjustments were made to compensate for these problems. The most important adjustment was to establish a zone, or buffer, around streams and floodplains so that only wetlands outside the buffer were considered isolated. This was done to compensate for the potential displacement of the NWI wetlands. For the most thorough analysis, a buffer of 250 feet was used, this being the maximum displacement estimated in the NWI. Buffers of 100 and 400 feet were also used to test the sensitivity of the analysis to buffer size, but buffer size was found to have little effect and those results are not reported here.

The estimates of isolated wetlands from this analysis are not precise. Although the best available data were used, limitations inherent in all three databases allow only a general estimate of isolated wetlands for the state. Use of a buffer may mean that the estimate is conservative in that a number of wetlands that are truly isolated fall within the buffer. In contrast, omission of some headwaters in the RF3 and of all floodzones in incorporated areas in the FEMA floodzone database may lead to an overestimate of isolated wetlands. The impact of these errors is impossible to assess.

Estimates of isolated wetlands in Illinois using a 250-foot buffer are shown in Table 2. Isolated wetlands, i.e., those more than 250 feet from a stream or floodzone, compose about 12.0% of Illinois' total wetlands acreage (Figure 6). Overall, this amounts to about 0.4% of Illinois land

area. Isolated wetlands complexes, defined as groups of physically adjacent wetlands, make up about 60% of the total number of wetland complexes in the state. The mean size of an isolated wetland is 1.1 acre, compared to the mean size for a non-isolated wetland of 12.3 acres.

Open water wetlands, mostly small ponds, make up the largest group of isolated wetlands in Illinois, accounting for about 7% of the state's wetland acreage and 57% of the isolated wetland acreage (Table 2, Figure 7). Isolated shallow marsh/wet meadow wetlands is the next largest group, with 3% of the total wetlands acreage and 26% of the isolated wetlands acreage. Large proportions of both these wetland types are isolated in Illinois, with 59% of open water wetland acreage and 24% of shallow marsh/wet meadow acreage being isolated (Figure 8). Other wetlands types are either less common in Illinois or less likely to be isolated, or both. However, 19% of deep marsh acreage consists of isolated wetlands, and forested wetland, which is the most common wetland type in Illinois, accounts for almost 10% of the state's isolated wetlands.

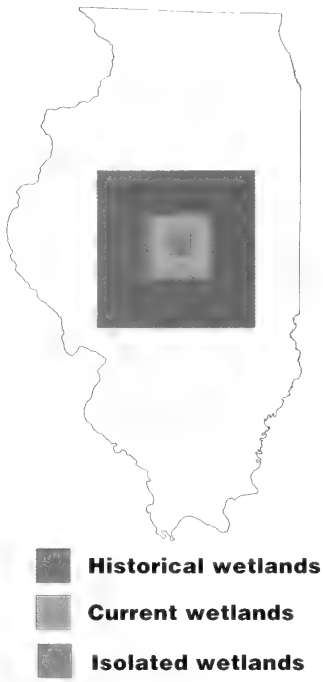

Figure 6. Relative sizes of historical wetlands (about 9.4 million acres), all current wetlands (about 1.25 million acres), and isolated wetlands (about 150,000 acres) in Illinois.

Illinois has lost about 90% of its wetland acreage.

Table 2. Total Illinois acreage for all wetlands vs. isolated wetlands for each wetland type. For this analysis, a wetland was considered isolated if it was located more than 250 feet from a stream or 100-year floodzone as indicated by GIS data.

	All Wetlands		Isolated Wetlands		
Wetland Type	Acreage	%	Acreage	% of all wetlands	% of isolated wetlands
All wetlands	1,251,240	100.0	150,118	12.0	100.0
Forest	757,305	60.5	14,296	1.1	9.5
Shallow marsh/wet meadow	162,867	13.0	39,644	3.2	26.4
Open water	143,301	11.5	84,887	6.8	56.5
Littoral lake	51,865	4.1	310	>0.1	0.2
Scrub-shrub	50,358	4.0	2,836	0.2	1.9
Deep marsh	37,685	3.0	7,208	0.6	4.8
Intermittent riverine	25,325	2.0	414	>0.1	0.3
Swamp	14,909	1.2	211	>0.1	0.1
Perennial riverine	3,960	0.3	138	>0.1	0.1
Littoral shore	2,894	0.2	174	>0.1	0.1
Littoral emergent	771	0.1	0.0	0.0	0.0

Isolated wetlands account for about 60% of Illinois' wetlands and about 12% of the state's wetland acreage.

Isolated wetlands cover about 0.4% of Illinois.

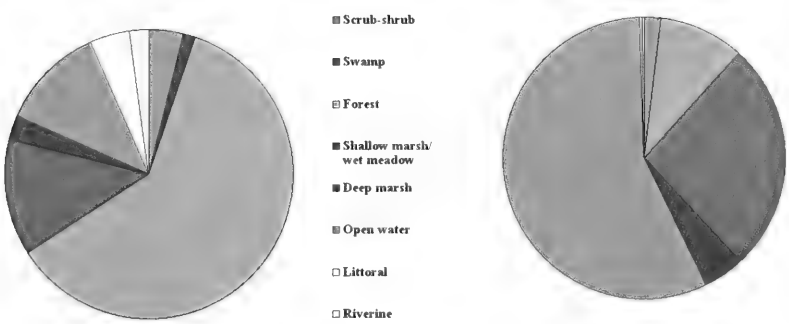

Figure 7. Proportions of different wetlands in Illinois.

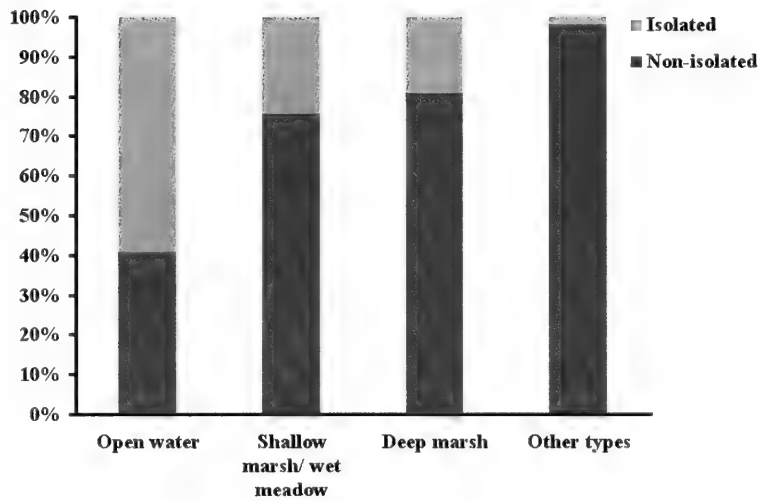

Figure 8. Relative importance of wetlands within wetland types in Illinois.

The average isolated wetland in Illinois is 1.1 acre in size.

A Watershed Study in Lake County, Illinois

To evaluate the accuracy of the statewide estimation of isolated wetlands using GIS analysis, wetland scientists from the Illinois Natural History Survey and the Illinois State Geological Survey conducted a field study in Lake County. A small (5,826 acres, or 9.1 square mile) watershed was selected that statewide GIS analysis indicated contained numerous isolated and non-isolated wetlands. In addition to the NWI, information on wetlands in Lake County is available from the 1991 Lake County Wetlands Inventory (LCWI), provided by the Lake County GIS. Not only is the LCWI more current than the NWI, it also was produced with a smaller focus and more regional expertise. Like the NWI, the LCWI was based on aerial photography.

The field survey was conducted in March and April of 2002. Each wetland complex in the NWI and the LCWI was surveyed (except for a few that were not accessible). The wetland status (wetland or non-wetland) and whether the complex was isolated or non-isolated were recorded for each complex. Wetlands found by the field survey but not included in the two inventories were also identified and mapped. A complete report of the results of the field survey and comparison with the GIS analysis can be found in Illinois Natural History Survey, Center for Biodiversity Technical Report 2002-8.

Figure 9 shows the results of the field survey. In this watershed, 129 isolated wetland complexes totaling 293 acres and 42 non-isolated wetlands totaling 344 acres were located (Figure 9, Table 3). In contrast, the GIS analysis using the NWI identified 99 isolated wetland complexes totaling 338 acres and 33 non-isolated wetlands totaling 337 acres.

From this study of a single small watershed, the main conclusions that can be drawn are:

- The GIS analysis was fairly effective at classifying the wetlands included in the NWI as isolated or non-isolated. About 67% of the wetland complexes and 75% of the wetland acreage identified as isolated vs. non-isolated using the GIS analysis were correctly classified.

- The NWI missed many small wetlands found by the field survey. Overall, 37% of the wetland complexes found in the field survey were not reported by the NWI. However, these accounted for only 7% of the wetlands acreage found by the survey. Isolated wetlands were much more likely to be missed by the NWI than were non-isolated wetlands.

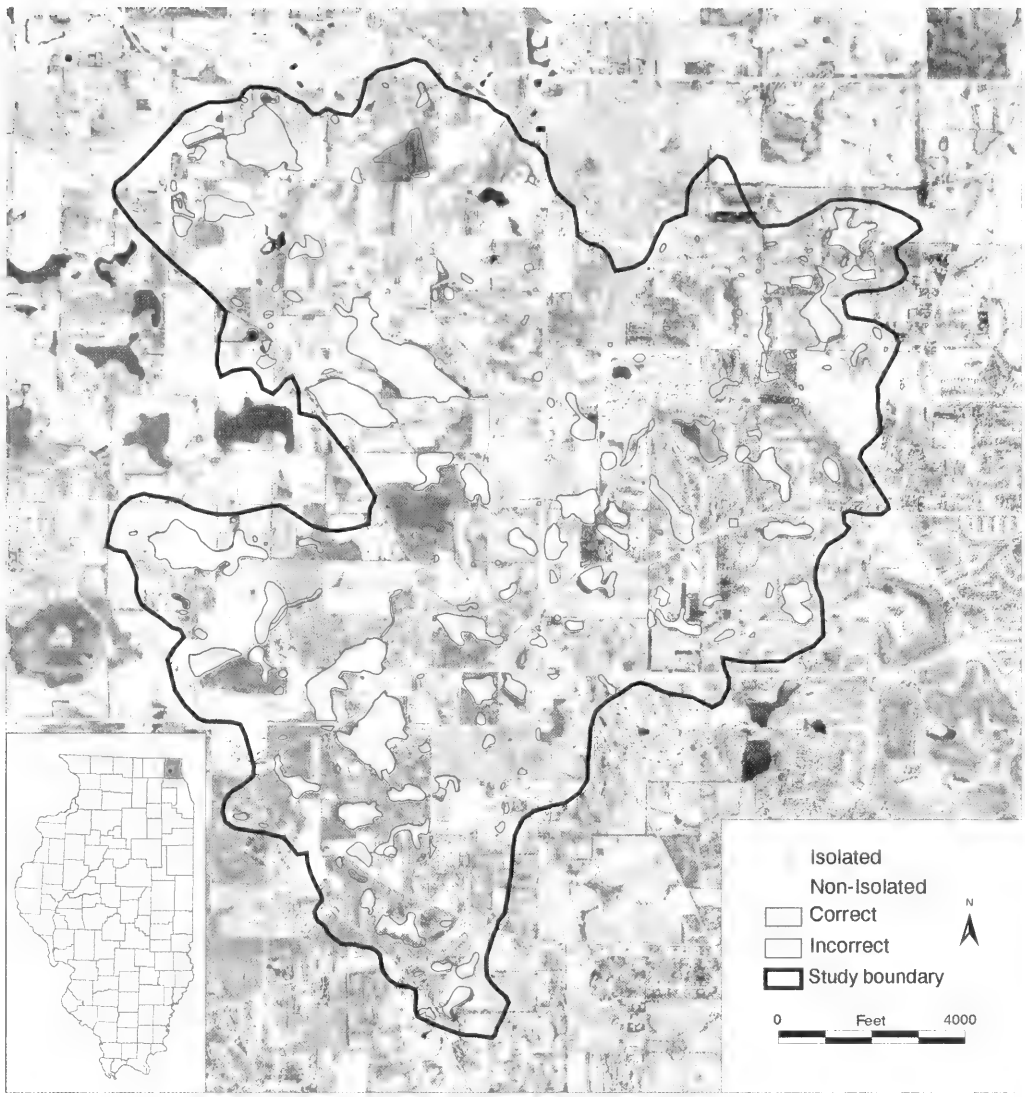

Figure 9. Watershed in Lake County, Illinois, surveyed in this study, showing isolated and non-isolated wetlands and whether each wetland located in the field survey was correctly identified using a Geographic Information System (GIS) analysis based on the National Wetlands Inventory (NWI). A wetland was considered correctly identified if the field survey and GIS analysis agreed on both the presence of the wetland and its status as isolated or non-isolated. Incorrectly identified wetlands differed in their isolation status as determined in the field survey and GIS analysis, were shown in the NWI but were not found in the field survey, or were found in the field survey but were not shown in the NWI.

Table 3. Comparison between wetlands identified using GIS analysis of the National Wetlands Inventory and a field survey for a watershed in Lake County, Illinois.

	GIS Analysis		Field Survey	
	Number	Acreage	Number	Acreage
Isolated	99	337.8	129	293.0
Non-Isolated	33	337.0	42	343.5
Total	132	674.8	171	636.5

- The NWI identified many sites as wetlands that the field survey found not to be wetlands. These amount to about 21% of the wetlands complexes and 13% of the wetlands acreage identified by the NWI. In some cases wetlands never existed at these sites and in other cases they had been destroyed since the NWI was completed.

- The field study found many cases where ditches or other hydrologic alterations connected formerly isolated wetlands to streams. These alterations were too small to detect in the aerial photography used for the GIS data sources and therefore require field visits for identification.

Existing resources allow only a rough estimate of isolated wetland number and size statewide, but cannot be used to determine accurately where wetlands exist and whether they are isolated.

- The LCWI identified more of the small wetlands missed by the NWI. Like the NWI, the LCWI still omitted many wetlands and identified wetlands where there are none. Again, the wetlands omitted by the LCWI tended to be small.

- The field survey covered much too small an area to allow valid statistical estimates of error rates in the statewide analysis. However, the information derived from the statewide analysis is a reasonable approximation of the actual acreage and number of complexes that occur in Illinois, but should be considered only an estimation.

A more accurate inventory of isolated wetlands in Illinois currently is not feasible. Aerial photography, the data source for the NWI and the LCWI, permits analysis of large areas that would be prohibitively expensive to survey on the ground. As this study demonstrates, however, aerial photography is limited in its ability to identify wetlands accurately. Furthermore, the available hydrology databases, which are required for determining isolation, are also incomplete and subject to uncertainty. It is likely that in the future, satellite imagery will allow the high resolution required for remote identification of wetlands. Until that time, locating the many small, isolated wetlands in the state will depend on field evaluation.

The unavailability of a complete and accurate inventory of isolated wetlands should not be seen as an impediment to adopting regulations to protect them. On-the-ground surveys currently are required for federally protected wetlands, and prior to the US Supreme Court ruling in SWANCC *v.* USACE were required for isolated wetlands. GIS tools like the NWI and LCWI are extremely valuable in that they allow predictions about the location of wetlands, and can be used to help target surveys. Unlike a full statewide survey, surveys associated with individual development projects are feasible and affordable.

Conclusions

The lack of an accurate inventory is not an impediment to developing regulations protecting isolated wetlands.

Isolated wetlands account for about 60% of the state's wetlands and about 12% of the state's wetland acreage, covering about 0.4% of Illinois. Most isolated wetlands in Illinois are small ponds, shallow marshes, and wet meadows. Although small in size, these wetlands serve important functions, reducing flooding and erosion, improving water quality by reducing sedimentation and pollutants, and recharging groundwater supplies. Although both isolated and non-isolated wetlands share these functions, isolated wetlands, in relationship to their number and size, are particularly effective at flood storage and sediment trapping. Isolated wetlands also are vital wildlife habitat. Despite their generally small size, isolated wetlands support a high diversity of plants and animals, many of which are not found in non-isolated wetlands and are threatened or endangered. Thus most "isolated" wetlands, despite having no surface connections to waterways, are interconnected hydrologically by way of groundwater and subsurface drainage and ecologically through the plants and animals that use them. Maintaining the full diversity of wetlands, including those that are isolated, benefits humans and living natural resources alike.

Although existing resources like the National Wetlands Inventory (NWI) can be used to estimate the number and acreage of isolated wetlands in Illinois, a field study demonstrated that the NWI and other regional data sources cannot be used to identify individual wetlands or determine which are isolated. An accurate inventory of isolated wetlands requires a field survey, which is not feasible on a statewide level. Fortunately, a complete and accurate statewide inventory is not needed prior to developing regulations protecting isolated wetlands.

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